U.S. NAVY MEDICINE

September-October 1986

U.S. NAVY MEDICINE

Vol. 77, No. 5
September-October 1986

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U.S. NAVY MEDICINE is published from appropriated funds by authority of the Naval Medical Command in accordance with Navy Publications and Printing Regulations P-35. Second class postage paid at Philadelphia, PA, and additional mailing offices. ISSN 0364-6807. The Secretary of the Navy has determined that this publication is necessary in the transaction of business required by law of the Department of the Navy. Funds for printing this publication have been approved by the Navy Publications and Printing Policy Committee. Articles, letters, and address changes may be forwarded to the Editor, *U.S. Navy Medicine*, Department of the Navy, Naval Medical Command (MEDCOM 00D4), Washington, DC 20372-5120. Telephone (Area Code 202) 653-1237, 653-1297; Autovon 294-1237, 294-1297. Contributions from the field are welcome and will be published as space permits, subject to editing and possible abridgment.

For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402.

NAVMED P-5088

POSTMASTER: Send change of address orders to U.S. Naval Publications and Forms Center, ATTN: Code 306, 5801 Tabor Avenue, Philadelphia, PA 19120.

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Quality Medical Care

"The way to a good reputation is to endeavor to be what you desire to appear!"—Socrates

And so it is with us. We deliver quality medical care and we must be seen as doing so. The practice of medicine has changed enormously. The massive technological complexity of modern medicine and the attendant increases in numbers of personnel required, the personnel requirements for the necessary supervisory and quality assurance activities, the increasing training required to support deployable medical systems—all affect the way we practice Navy medicine in the eighth decade of the 20th century. Resources have not grown commensurate with these changes. Our "overhead" is already too much a part of our costs, both in human and dollar terms. We must take corrective action soon in order to preserve the viability and vitality of the system. We must not be bound by parochial interests which force us to maintain facilities where they are not needed and to build facilities where they are not justified. If we do not receive the resources to fulfill all our requirements, we have to reluctantly, regretfully but necessarily make cuts in the services provided. In order to survive in this tightly constrained asset environment, we must have the authority to close inpatient services in marginal areas if necessary or to close selectively specific services at other facilities. To do otherwise would mean deliberately accepting an indefensible reduction in the quality of care provided to the largest numbers of authorized recipients.

I know how painful it is to have to disengage patients—painful for *you* and the patient. I know the importance of maintaining the training base in order to meet our priority commitments. You know what those priority commitments are—the operating forces, Navy and Marine Corps, our overseas activities, and our isolated CONUS facilities. There is also the requirement to take care of the other members of the Navy family. Additional military personnel to meet all these needs will not be forthcoming, so it is imperative that we be as innovative and inventive as possible. When we cannot meet our requirements in-house, we must explore the expanded use of contracts for services of civilian hires. We must also use other initiatives along with CHAMPUS. These are not cuts or compromises we wish to make, or would make were there any personnel or fiscal alternatives.

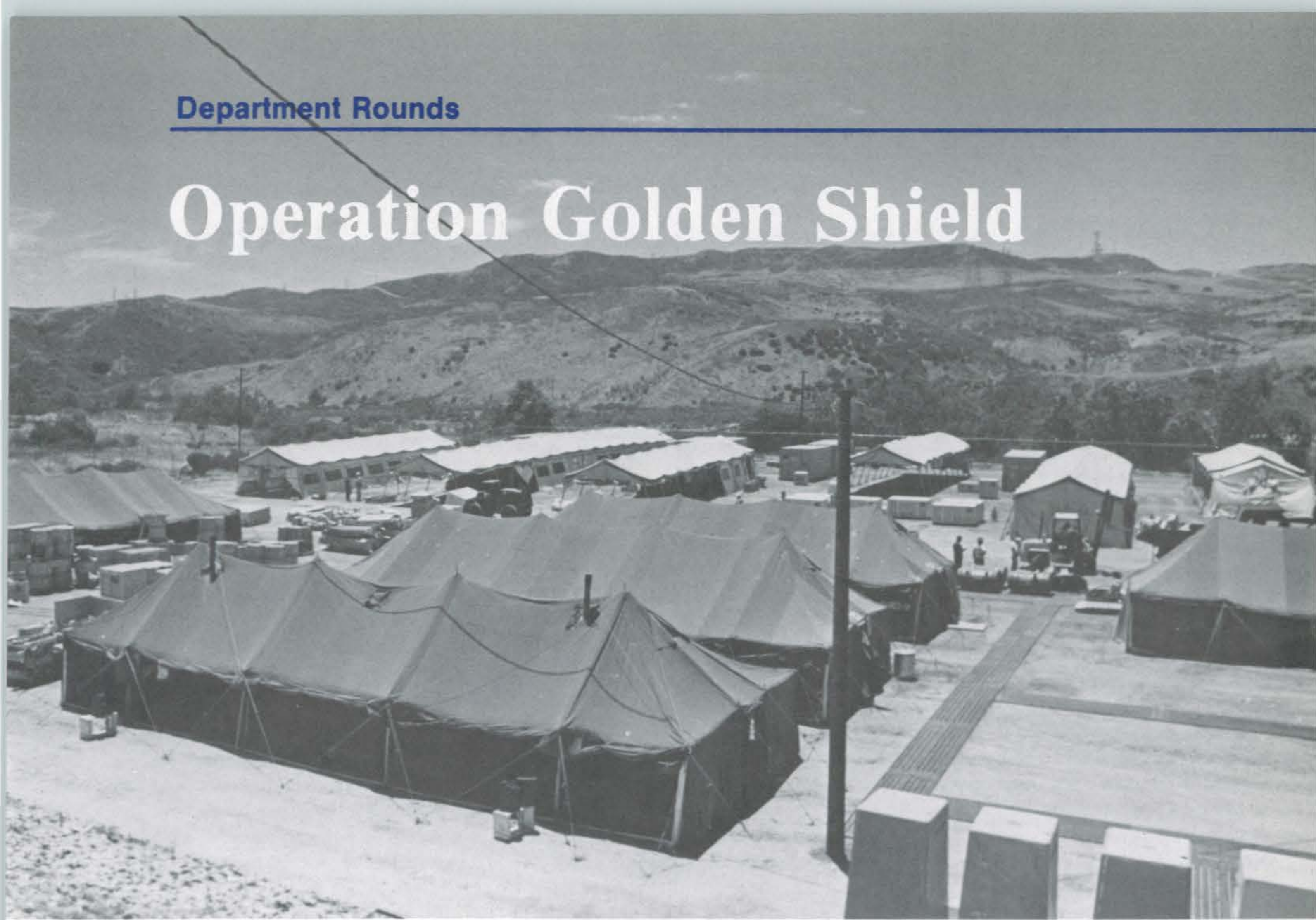
I want to emerge from this with a practice environment for our providers in which they can function efficiently and a health care environment for our patients which will provide quality care in a consistent manner. You and they deserve that.

I will discuss these steps with you as they occur and I depend on each of you to explain them to our patients, to emphasize that it is in their best interests that we maintain quality as our guiding principle, rather than quantity of service.

To that end, we must also realize that quality care involves not only quality medicine, but quality communication with our patients. They must not only be recipients of the best care we can provide, but also of information, assurance and evidence of the *caring* which goes with care. Patient explanation is an important part of that process. That will also be the subject of later discussion with you.

RADM Joseph S. Cassells, MC

Operation Golden Shield



A fleet hospital comes together. Light-colored tents in background are the wards, which were subsequently connected by a perpendicular tent corridor. Darker tents, foreground, form the base camp. Shipping containers were staged in an adjacent area to the right, not shown.

The Navy's extensive Fleet Hospital Program took a key step from the drawing board to reality in mid-July when major components of a fleet hospital came together for the first time in the field.

The medical/surgical core of a 250-bed fleet hospital was erected and outfitted during a test and evaluation exercise called Operation Golden Shield at the Marine Corps Base, Camp Pendleton, CA. The operation concluded with a casualty management exercise 14 July.

The Navy plans to procure 23 modular, containerized fleet hospitals by 1992. All will be pre-positioned around the world—some aboard ship, the others in warehouses—for rapid use in the event of war or other emergencies. Eight of the fleet hospitals will be designated for active duty manning; the Naval Reserve will staff the rest. In all, some 25,000 personnel will be needed to staff the hospitals: 7,000 for the active duty facilities and about 18,000 reservists.

The facility erected during Golden Shield will become the permanent training site for personnel being assigned to fleet hospitals. It will have a staff of 20 training and support personnel and will be known as the Fleet Hospital Training Activity, a detachment of the Naval School of Health Sciences in nearby San Diego.

The Golden Shield exercise brought together in a working environment for the first time elements of the three major commands responsible for the Fleet Hospital Program: Naval Medical Command, Naval Supply Systems Command, and the Naval Construction Force. The program is under the overall direction of the Director, Naval Medicine.

Golden Shield was largely a Naval Reserve effort, with some 300 reservists involved in assembling and outfitting the hospital. The exercise was planned and coordinated by the Reserve Seabees—the Reserve Naval Construction Force—while Reserve medical and support units assisted

Teamwork was the name of the game at Operation Golden Shield. Here, medical unit personnel and Seabee work side-by-side to complete assembly of a TEMPER tent. Right: *Hospital equipment came in boxes which were set outside of appropriate wards for unpacking.*

with assembly and hospital staffing. The marines at Camp Pendleton assisted by grading and preparing the hospital site.

"There are a lot of players involved in this program, and they were all represented during Operation Golden Shield," said RADM Lewis Mantel, MC, Deputy Director of Naval Medicine, in comments at Camp Pendleton as the exercise concluded. "We've learned a lot about putting up a fleet hospital and about working together—medical people, Seabees, other support units, and marines. Active and Reserve personnel worked as a team.

"What Golden Shield has shown is that with proper planning and the

A ward set up and stocked

cooperation of all involved, the Fleet Hospital Program can and will work," he added. "I think we're off to a great start."

Timely completion of the Camp Pendleton facility was crucial to allow for the scheduled start in September of the huge training effort associated with the Fleet Hospital Program. Planned is a training cycle of 20 annual 2-week courses, with 164 students each. The Naval Health Sciences Education and Training Command (HSETC) is overseeing the training.

The Fleet Hospital Program was undertaken to replenish the Navy's supply of mobile hospitals that was depleted during the Vietnam war. The new generation of field hospitals packages the most modern facilities and equipment into a highly capable and mobile format.

The main objective of the Fleet Hospital Program is to bring medical facilities closer to combat operations. Specifically, the program is designed to:

- Hasten the return to duty of wounded troops, thus reducing the need for replacements;
- Diminish the need for air support, by lowering requirements for medical evacuations and troop replacements; and
- Provide for rapid deployment in support of combat operations around the world.

The hospitals themselves are a combination of large expandable "TEMPER" tents (Tent, Extendable, Modular, Personnel) and standard-sized "ISO" (International Standard Organization) shipping containers. Some of the containers are expandable and, when linked to the tents, form parts of the hospital such as the operating room, pharmacy, and X-ray unit. The other containers carry all the equipment and supplies for the hospital, including the tents.

The fleet hospitals come in three sizes: 250, 500, and 1,000 beds. The 250- and 500-bed hospitals would be located within 70 miles of the forward edge of combat areas, while the 1,000-bed facilities would be located outside the combat zone.

The training facility erected during Golden Shield was about one-fifth the size of a 250-bed hospital. Reserve Seabees, medical, and support personnel assembled and outfitted it in 5 days. The hospitals can be erected in 8-10 days after a site has been prepared. Assembly takes place in three stages:

First, a small air detachment—mostly Seabees—arrives at the site, which already would have been leveled by other Seabees or similar military construction units. They then lay out the assembly plan, stake the site, and begin staging the containers. (Some 325 containers are required for a 250-bed hospital.)

A larger advance party then arrives to finish the staging of containers and to assemble the base camp and support facilities. This group is mainly Seabees, with some support and medical personnel.

Finally, the rest of the staff, including all medical personnel, arrives to finish the base camp and to assemble and outfit the hospital.

Some 600 persons would be required to staff a 250-bed hospital. Personnel would increase according to

Casualty Receiving Ward stands ready for business.

Photos by U.S. Marine Corps

Conferring at Camp Pendleton as Operation Golden Shield concluded are, from left: RADM Mantel, VADM Thomas J. Hughes, Deputy Chief of Naval Operations for Logistics, who toured the hospital site, and MGEN Robert E. Haebel, USMC, base commanding general.

hospital size, with about 1,500 persons needed for the 1,000-bed facilities. In each case, about two-thirds of the staff would be medical, the rest Seabees and other support personnel. Overall, the Fleet Hospital Program would add a total of 13,250 beds to existing Navy medical facilities.

"This represents a commitment to our sailors and marines to provide the best possible medical care as quickly as possible during combat," said RADM Mantel. "It should result in a significant improvement in our combat casualty capability." □

—Headquarters, Commander Reserve Naval Construction Force, First Naval Construction Brigade, Greensboro, NC 27409.

Analysis of Stool Chemistries in the Evaluation of Diarrheal Disorders

LCDR David A. Johnson, MC, USNR

In evaluating patients with chronic diarrhea, analysis of stool chemistries is a valuable adjunct in defining the clinical syndrome. A working knowledge of normal colonic physiology and the alterations caused by drugs or disease states further serves to assist the clinician in an oftentimes difficult diagnostic dilemma. This review will analyze the various stool chemistries in health and disease in order that clinicians may fully understand the usefulness of these tests and avoid diagnostic pitfalls.

Osmolality

With interpretation of stool chemistries, differentiation between a secretory and a osmotic diarrhea begins with determination of the osmotic gap. Stool osmolality is calculated as: [Na] stool + [K] × 2; the multiplication by 2 is to account for anions. This value is then compared to the measured osmolality of the stool fluid, as determined by freezing point depression. The normal range of osmolality on freshly collected diarrhea stool is between 280-330 mosmol. The difference between measured and calculated osmolality is the osmotic gap. There are several factors which may alter the measured osmolality, so the osmolality of plasma (290 mosmol) is used to determine more accurately the osmotic gap. In secretory diarrheal disorders, the osmolality of the stool is close to the osmolality of plasma, hence a low osmotic gap, generally <40 mosmol. The causes of secretory diarrhea are numerous and are listed, in part, in Table 1. An example of the stool chemistries seen with secretory diarrhea is shown with patient 1 (Table 2). On the other hand, the presence of an osmotically active solute in the stool fluid elevates the osmotic gap, suggestive of an osmotic diarrhea. Traditionally, an osmotic gap of >50 has been accepted as consistent with osmotic diarrhea, although some investigators suggest that this should be substantially higher, e.g., 100 mosmol, to separate more clearly those patients with true osmotic diarrhea. The more common causes of osmotic diarrhea are shown in Table 3 and an example of stool chemistries for a patient with an osmotic diarrhea is seen with patient 2 (Table 2).

Measured fecal fluid osmolality values can be potentially misleading, but on some occasions may provide useful clinical information. Stool osmolality increases considerably after storage at room temperature for 24 hours. This presumably is due to bacterial metabolism of the contents of the stool with formation of osmotically active smaller molecular substances. This increase in stool osmolality can be prevented by refrigeration of the stool or by prior administration of antibiotics to the patient. Addition of urine to the fecal fluid can also cause a significant elevation of

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TABLE 1
Causes of Secretory Diarrhea

Laxatives (including phenolphthalein, biscodyl, senna, dioctyl sodium succinate)
Secretagogues—serotonin, VIP, calcitonin, prostaglandins
Bile salts
Fatty acids
Ileocecal tuberculosis
Villous adenoma
Enterotoxins
Zollinger-Ellison syndrome
Giardiasis
Intestinal lymphoma
Idiopathic

measured, as well as calculated stool osmolality. Marked dehydration can also potentially result in an elevated stool osmolality, although this should be clinically apparent and serum osmolality should also be elevated.

Low measured stool osmolality in the absence of low serum osmolality is suggestive of water addition to the stool. At times, it is clinically difficult to delineate factitious from true osmotic diarrhea. The key here is that although both have low fecal fluid electrolytes, the measured osmolality is elevated in osmotic diarrhea and low with water addition. A reliable general principle to follow is that stool osmolality cannot be lowered below 240 mosmol even with a severe secretory diarrhea such as cholera.

Sodium/Potassium

As previously discussed, the primary value of determining these two electrolyte values is in the calculation of the osmotic gap. There are, however, a few clinical conditions that may be suggested by abnormalities in either of these two values. Normal sodium and potassium values are shown in Table 4. Elevation in sodium can be seen with secretory diarrhea (Table 2—patient 1), but pronounced elevations are unusual. If this is coupled with a pronounced elevation in stool osmolality and a low osmotic gap, addition of urine should be strongly suspected (Table 2—patient 4). High potassium levels in fecal fluid are typical of villous adenoma or collagenous colitis (Table 2—patient 5).

Chloride/Bicarbonate

Chloride concentrations in fecal fluid are generally low due to a colonic and ileal luminal exchange with plasma bicarbonate. A high bicarbonate in the stool would be expected, but it is not seen. Bacterial fermentation of unabsorbed carbohydrates results in formation of organic acids (acetate, proprionate, butyrate, and lactate) which lowers the concentration of bicarbonate. Normal values for chloride and bicarbonate are shown in Table 4, although these chemistries are of little clinical value. However, in the rare pediatric disease, congenital chloridorrhea, fecal fluid chloride measurements can be diagnostic. The clinical picture consists of chronic diarrhea, marked fecal loss of chloride, hypochloremia, and metabolic alkalosis. In this disorder, fecal fluid chloride is more than the sum of sodium and potassium.

Magnesium/Sulfate/ Phosphate

These chemistries are often helpful in determination of occult cathartic use causing osmotic diarrhea. The osmotic gap is high and the clinical clue is the distinct magnesium elevation, suggesting use of a magnesium-based cathartic or antacid (Table 2—patient 6). Determination of the SO_4 or PO_4 may be helpful in further determining of the agent used, e.g., $MgSO_4$ -Epsom Salt, $MgPO_4$-Fleet's enema, or sodium phosphate. Normal values for Mg, SO_4, and PO_4 are shown in Table 4.

Stool pH

Normal stool pH is neutral, i.e., approximately 7. Elevation of pH may suggest the usage of antacids or milk of magnesia. Acidic stool pH (usually 5-6) is generally seen with carbohydrate malabsorption and consequent bacterial metabolism and formation of short chain fatty acids. Alkalinization

TABLE 2
Examples of Stool Chemistries in Patients With Various Diarrheal Disorders

Patient	*Osmolality*	*Na+*	*K+*	*pH*	*Mg2+*	*Diagnosis*
1	280	100	40	7.5		Cholera
2	345	45	37	5.6		Carbohydrate malabsorption
3	77	12	10	7.0		H O in stool
4	390	181	32	7.0		Urine in stool
5	280	37	110	7.5		Villous adenoma
6	310	10	13	7.0	120	Magnesium cathartic use

TABLE 3
Causes of Osmotic Diarrhea

Magnesium antacids
Disaccharidase deficiencies (primary or secondary)
Monosaccharidase deficiences (primary or secondary)
Polyethylene glycol gastrointestinal lavage solution (Golytely®, Colyte®)
Lactulose
Excess "sugar-free" product ingestion—mannitol, sorbitol, xylitol
Excess ingestion of complex carbohydrates which are incompletely digested and absorbed, e.g., fruits: apples, peaches, prunes, pears; vegetables: beans, brussel sprouts, cabbage; grains: wheats, oats, rice
Sodium phosphate
Sodium citrate

TABLE 4
Normal Average Stool Chemistry Values (meg/L) for Fluid Passing Through Rectum

Sodium	40
Potassium	90
Chloride	15
Bicarbonate	30
Magnesium	< 10
Sulfate	< 5
Phosphate	< 5

of the stool and/or urine should be done to detect the use of phenolphthalein-containing laxatives (which generally cause a secretory-type diarrhea). A drop of 1 N NaOH is added to about 3 cc of stool supernate to raise the pH to 9 which will result in the development of a pink/red color if phenolphthalein is present. This can be confirmed by spectrophotometry because phenolphthalein has a specific absorption rate at 550 to 555 $m\mu$. Addition of 10 N NaOH to provide base excess will then form a trisodium salt which again is colorless.

Summary

The measurement of stool chemistries is a simple, readily available diagnostic test which may assist the clinician in evaluation of diarrheal disorders. An understanding of stool chemistries in various disorders will provide the clinician with a more directed diagnostic approach to the various diarrheal disease states. In patients where the diagnosis is not apparent following a careful history, physical examination, and a few directed diagnostic tests or procedures, we recommend that stool chemistries be obtained as part of the clinical evaluation.

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First Annual Research Competition

On 17 June 1986, Naval Hospital, Bethesda hosted the first Annual Resident/Fellow Research Competition. CAPT E.S. Amis, Jr., commanding officer of the hospital instituted the competition in an effort to support the Navy's graduate medical education programs, and to recognize outstanding research. The competition was open to all residents/fellows in good standing at each of the Navy's four teaching hospitals—Portsmouth, Bethesda, San Diego, and Oakland.

Residents/fellows interested in representing their command were invited to submit abstracts for consideration. Each command then selected a single submission as a representative.

After tough initial competition within each hospital for the honor to compete, the final four representatives gathered at Naval Hospital, Bethesda to vie for the title of "Outstanding Resident/Fellow in Research" for the Navy Medical Department.

A panel made up of RADM J.S. Cassells, MC, Commander, NAVMEDCOM; CAPT W.E. Hirschfeld, DC, commanding officer, HSETC; and Randall K. Holmes, M.D., Ph.D., associate dean for academic affairs at USUHS, Bethesda, made the final selection. The residents were judged in three main categories—importance of data, quality of presentation, and handling of questions. Given the superior quality of each presentation, selecting a "best among equals" was an unenviable task.

The competition began with CAPT Amis' "Welcome Aboard" message, in which he stressed the importance of continued research by Medical Corps personnel. CDR Bart Chernow, MC, who set up the competition as head of the Office of Academic Affairs, acted as moderator through the day's events.

LCDR Brett Scott, MC, senior resident in the Department of Neurosurgery at Naval Hospital, Bethesda, first presented his research on the use of 2-deoxy-D-glucose as a chemotherapeutic agent in the war against cancer. LT Joseph Wilson, MC, USNR, an ENT resident at Naval Hospital, Portsmouth, gave the second presentation. Dr. Wilson's work focused on the intracranial complications of sinusitis and their management. The third presentation was delivered by LT Jack Davis, MC, resident in the Department of OB/GYN at Naval Hospital, Oakland. Dr. Davis' submission dealt with the development of erythropoiesis in infants of mothers suffering from diabetes. The final competitor, LCDR Michael Pratt, MC, senior otolaryngology resident at Naval Hospital, San Diego, presented a synopsis on his study of microsurgical application of freeze-dried allografts of veins and arteries.

After nearly 30 minutes of deliberation, RADM Cassells announced the winner, LCDR Pratt of San Diego. Dr. Pratt received a certificate of commendation, and a plaque which will be kept at his command until the next competition.

The first Annual Resident/Fellow Research Competition was a resounding success, and was another step toward academic excellence in the Medical Department. Next year's competition will be held at Naval Hospital, San Diego.

—Story by HN Peter Marghella, USN

Photo by HM1 Thomas Kelley

RADM Cassells presents LCDR Pratt with the first Annual Resident/Fellow Research Competition plaque.

With *Iowa* at Sea

Battleship. Big guns, brute power, invincibility. Remember the Maine, *an outraged nation's war cry. Dreadnoughts with gilded bows. The Great White Fleet. Teddy Roosevelt's big stick.* Arizona, *one of "the day of infamy's" shattered victims. Mighty* Missouri, *upon whose crowded deck World War II's final chapter was written.*

The word battleship for me was a flashback to childhood: Photographs in a scrapbook, Sunday night watching "Victory at Sea," and a 3-dollar plastic model of the Missouri *on a cluttered bureau. Adulthood came as the battleship era ended, and the chance of ever seeing one of the big ones outside a mothballed fleet seemed an opportunity missed. And then they were back—modernized, rearmed, and as impressive as ever.**

There was no mistaking *Iowa.* Low in the water, the knife-edged profile and massive 16-inch gun turrets set her apart from the other warships berthed nearby. I climbed the brow and quickly noted the frantic activity of dungareed sailors and the jumbled smells of paint, polish, and solvent. Some men chipped and primed bare metal; others applied a final coat of battleship gray to her sweeping fo'c'sle deck, taking care not to smear the freshly enameled black anchor chain. "Oh, to have the Brasso concession on this ship," I mused. It seemed as though everyone who was not painting was polishing an ample collection of brass fittings.

The decks were getting at least as much attention. Crewmen on all fours were drilling out and replacing the wooden plugs called "dutchmen," in the teak planks. Those same decks were soon to be holystoned** in the old Navy fashion. When that backbreaking job was finished, a sailor assured me, the spotless blonde timber would surely dazzle, if not blind, the unwary.

Iowa was to lead the parade of tall ships in New York's salute to the Statue of Liberty in a few days and the President of the United States was due aboard. That explained the cleaning frenzy, but I still felt like the guest who arrives early to a dinner party and surprises the hostess in hair rollers doing some last minute vacuuming.

HMCS Irv Clifton, representing the ship's medical department, escorted me aft to my quarters. I would bunk and mess with the chiefs. The 28-bed sickbay ward and all available staterooms had been pressed into service to accommodate an unusual number and variety of guests—Secret Service agents, Marine Corps and Air Force officers, Navy reservists, civilian contractors and technicians, and an assistant Secretary of the Navy.

Weighing the equivalent of a small pickup truck, a 16-inch shell emerges from a cone of smoke and flame as a dark speck against the sky.

Underway

The following morning we cast off and were soon free of our tugs and underway. The 2-day cruise was to be a

*Three *Iowa* class battleships are back—*Iowa* (BB-61), *New Jersey* (BB-62), and *Missouri* (BB-63). *Wisconsin* (BB-64) will undergo major refitting in the near future.

**Holystoning came about in the days of sail when all naval vessels had wooden decks. An implement, looking much like a fire brick, has a hole in which a broomstick can be inserted. Armed with these abrasive "mops," sailors line up many abreast. A solution of lye, soap, and fine sand is thrown down and, on command and to a cadence, the men scrub the deck moving the bricks back and forth with the grain of the planks. The detail then moves down the deck, holystoning it in sections. The finished planks are rinsed with saltwater.

Photos by the Editor

dress rehearsal for *Iowa*'s Fourth of July performance. Her navigators and pilots, using a chart of New York Bay superimposed on one of Hampton Roads and environs, could familiarize themselves with the buoys and other navigational aids they would encounter up north.

Anchor details would also get to practice as would the other crewmen who, dressed in summer whites, were to line the rail for hours as helicopters repeatedly simulated the arrival and departure of VIP's on the afterdeck. But the climactic event was to be gunnery practice. Everyone looked forward to seeing *Iowa*'s heavy artillery in action.

With this packed calendar of activities, I still hoped to learn something about how *Iowa*'s medical department functioned. Was the brand of medicine practiced here any different from what one might find aboard a carrier, a destroyer, or any other naval vessel? Did the ship's age and unique environment present special problems?

I began my first full day aboard by getting the feel of the ship. HMCS Clifton guided me through the bridge,

gun turrets, engine rooms, and other engineering spaces. Later I explored the machine shop and galleys. I talked with sailors along the way and sensed the special feeling they had for their ship. "Kids ask me what ship I'm on," HMCS Clifton volunteered, "and I tell them the battleship *Iowa*. Their eyes widen and they say 'What's it like? I've always wanted to go aboard a battleship.' That's the mystique. You see the pride in the way our crewmen wear their uniforms and the way they carry themselves." My fascination with that special mystique grew with each discovery.

One of *Iowa*'s most intriguing aspects is her distinguished history. Launched in 1942 and commissioned the following year, this lead ship of her class had an original complement of 2,800 officers and men, many of whom were from the Hawkeye state and had never seen the sea. Her first assignment was transporting President Roosevelt part way to the Teheran Conference for his historic meeting with Winston Churchill and Joseph Stalin.

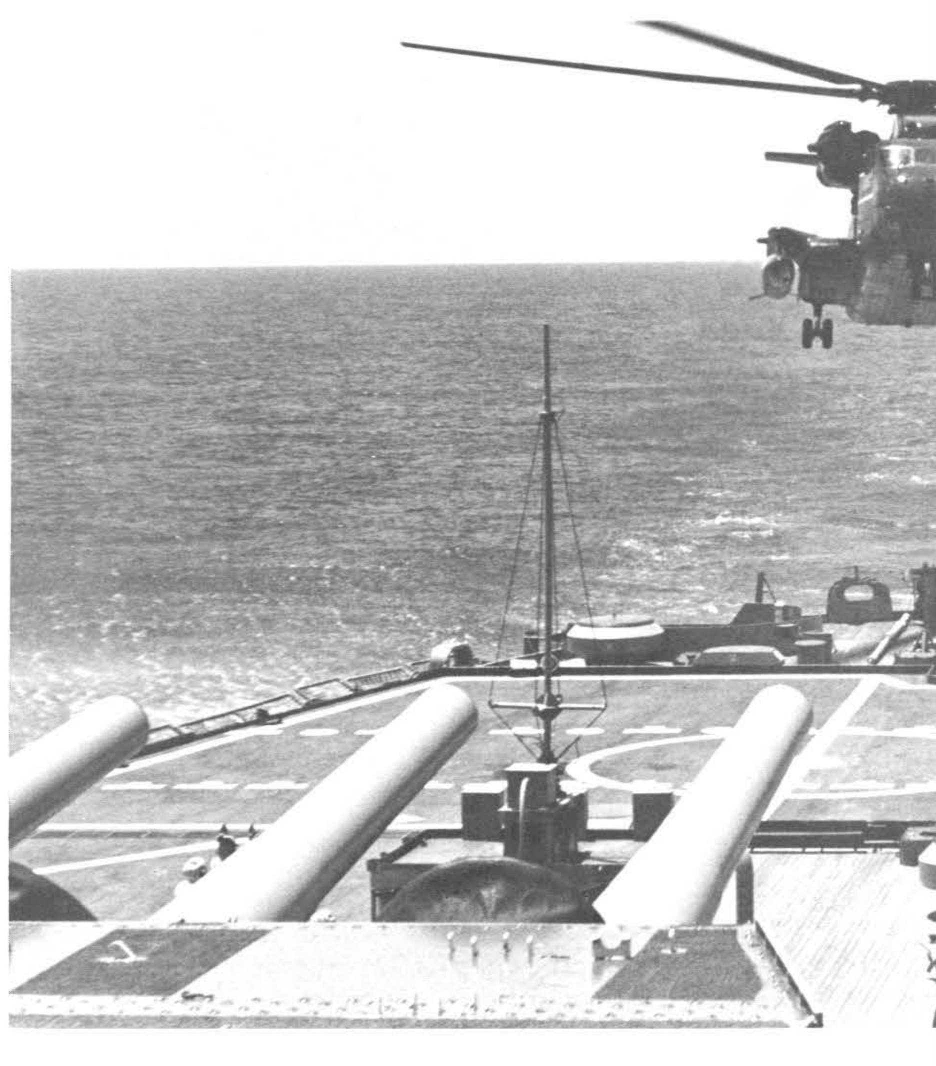
In the Pacific war, the ship supported carrier air strikes against Kwajalein and Eniwetok atolls in the Marshall Islands. On 18 May 1944 *Iowa* took part in the bombardment of Mili Atoll in the Marshalls. A memento of that action remains with her today—a small dent in turret two inflicted by a 4.7-inch Japanese projectile. As ADM William F. Halsey's flagship, *Iowa* was in Tokyo Bay with *Missouri* for the Japanese surrender.

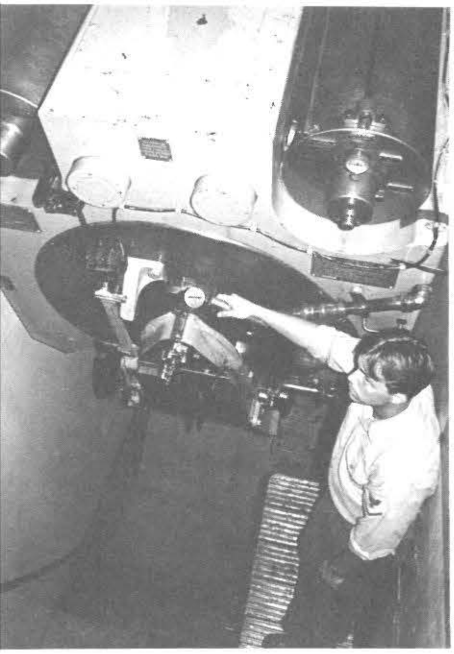
Decommissioned and mothballed at San Francisco in 1949, her retirement was short. On 1 April 1951 she returned as flagship of the 7th Fleet, and fired over 4,500 16-inch shells at the Korean coast in support of United Nations forces. The ship remained part of the fleet until decommissioning in 1958 at which time she had accumulated 11 battle stars.

The latest resurrection of *Iowa* began in 1982. She was towed from Philadelphia to New Orleans, where

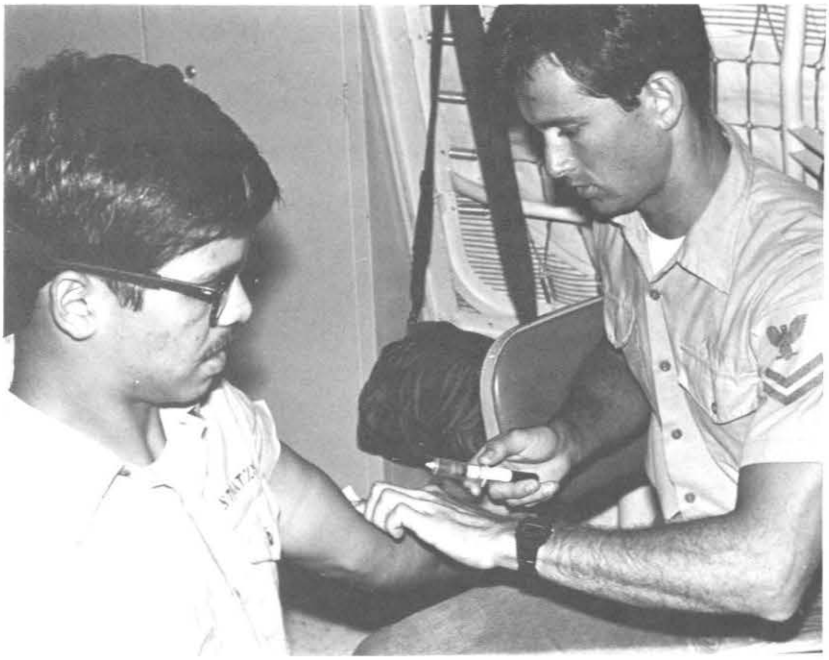
Right: *The breech of a 16-inch gun. Gunner's mates maintain and load the world's largest cannons much the way their predecessors did on* Iowa *over 41 years ago.*

CDR Louis J. Kroot, *senior medical officer.* Right: *In preparation for Liberty Weekend in New York Harbor, a helicopter simulates the President's arrival aboard* Iowa.





A corpsman is always present during helicopter takeoffs and landings. *Below:* *Beneath the turret lie the projectile room and magazine.*



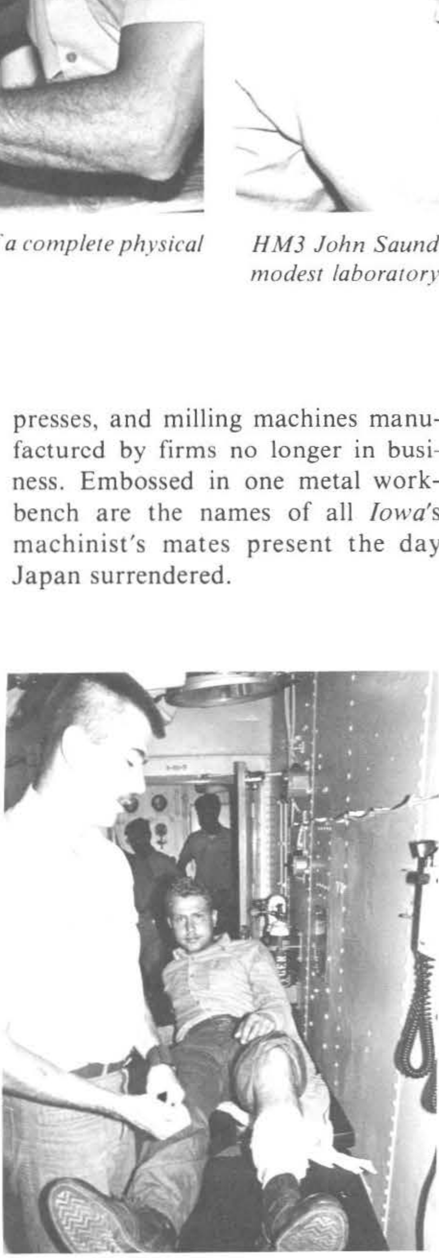
HM2 William Foody draws blood as part of a complete physical exam.

HM3 John Saunders does a complete blood count in medical's modest laboratory.

shipyard workers repaired her hull and replaced obsolete equipment. A year later modernization continued in Pascagoula, MS. There she was outfitted with advanced communications and radar, countermeasures systems, Tomahawk and Harpoon cruise missile systems, and four Phalanx close-in defensive weapons systems. Her long dormant 16-inch and 5-inch guns were also refurbished and the afterdeck reinforced to handle all but the heaviest helicopters.

Modernization of crew spaces and the addition of air conditioning and sewage holding and treatment facilities received high priority. The boilers and engines were completely overhauled and converted to burn standard Navy distillate fuel. On 28 April 1984 *Iowa* witnessed her third commissioning ceremony.

Despite extreme rejuvenation, the ship retains much of her old character. Reminders of the past are everywhere, even down to a tiny museum chock full of World War II and Korean War memorabilia. Her fully operational machine shop contains lathes, drill presses, and milling machines manufactured by firms no longer in business. Embossed in one metal workbench are the names of all *Iowa*'s machinist's mates present the day Japan surrendered.



HM2 John Burton dresses a leg injury in Iowa*'s sickbay.*

I marveled at the ship's lustrous woodwork and the ubiquitous brass—rail turnbuckles, steam pipes, stanchions, switchplates, and engine telegraphs. I had to remind myself that the yellow metal was not an extravagance back in 1942.

Nor was her prodigious steel armor. It was and continues to make *Iowa* one of the most survivable ships afloat. The turret fronts and conning tower are protected by 17.5 inches. In places her sides boast a thickness of 12.1 inches of steel. The armor belt that surrounds her at and below the waterline protects where any vessel is most vulnerable.

Other features are neither impressive nor quaint. Ladders between decks are steeper than any on a modern ship. Hatches are not only narrow, but the high rises extending up from the deck make these "knee-knockers" true to their name. Overheads are low, and the worst offending projections have been padded to prevent injury. All this makes one wonder whether sailors were, in fact, smaller in the 1940's.

The laundry is a high heat stress environment aboard ship. Here HM3 Willard Balmer monitors air temperature near a dryer.

HM3 Michael Lamorgese (left) and HM3 David McGinnis suture a minor head laceration.

Iowa Medical

The medical department snakes its way around one of the 16-inch gun barbettes. It is relatively tiny and cramped for a ship so large, but with space at a premium, the staff of 18 corpsmen and two general medical officers make do caring for the ship's 60 officers and 1,500 men. HMCS Clifton and CDR Louis J. Kroot, the senior medical officer, quickly answered my questions about the uniqueness of battleship medicine. Medical care is both different and very much the same as on other ships. Dr. Kroot and his men treat more than their share of scalp lacerations and other injuries caused by low overheads. However, the staff pursues occupational and industrial medicine with the same zeal as on any Navy ship. The heat stress and hearing conservation programs are the biggest concerns. Because noise is omnipresent and not confined to just some of the ship's spaces, all crewmembers are tested annually in *Iowa*'s double-walled audio booth. That translates into more than 1,500 audiograms a year. Educating the crew to recognize and protect itself from heat stress and noise is a top priority.

Monitoring hazardous materials such as asbestos, mercury, and other toxic materials is just as important. At least some World War II vintage pressure gauges and gyroscopes containing mercury are still operational. An annual industrial hygiene survey checks for the presence of this metal as well as for asbestos, fumes of cadmium, lead, chromium, acid, and xylene.

HMC Robert Huffine screens patients during sickcall.

As small and busy as it is, the medical department can expect more business when *Iowa* begins to operate as part of a battleship battle group in the near future. The ship will then be providing medical services to the smaller vessels in the group much the way a carrier does for a carrier battle group. When fully operational, the battleship battle group will have a surgeon, an anesthetist, and a senior lab technician, giving *Iowa* and its dependent ships self-sufficiency for almost any medical emergency.

Gunnery Practice

At 1030 hours on the second day out, I joined GMCM Charles Hill, chief gunner's mate, on the 0-5 deck for gunnery practice (see sidebar). We were cruising about 60 miles off Vir-

U.S. Navy photo

USS Iowa *cruises in the Gulf of Mexico during 1984 sea trials.*

ginia Beach in dead calm water. At the chief's suggestion, I stationed myself just above the forward port 5-inch gun mount, ear protection in place and camera and tape recorder at the ready. The target was a tug-towed sled about 10 miles off our port bow, a mere chip shot for artillery that can reach out 23 miles. Without warning, orange flame and acrid powder smoke erupted from one of the 16-inch barrels accompanied by a sledge-hammerlike shock wave and heat blast that knocked the air from my lungs. Almost a full minute later the nonexplosive round plowed into the sea sending up a geyser of water that arose skyward in slow motion. The impact was just aft of the target sled.

Two hours and many rounds later the exercise ended with the tug reporting all shots well within the target area. GMCM Hill and *Iowa*'s skipper both seemed pleased with the shooting.

I left the ship that evening in style. After handshakes and goodbyes, I boarded a helicopter with several other passengers for a quick ride back to NAS Norfolk. We hovered just above the fantail for a brief moment and then ascended sharply to starboard. From my small window, the 887-foot hull below had shrunk to the size and shape of a Coke bottle. The pilot brought us around for a farewell pass and we shot some last-minute pictures. Even from that vantage, *Iowa* still looked every bit a battleship as she cruised slowly in the gentle seas with sailors yet lining her rail. In less than a week they and their ship would be steaming into New York Harbor for a very special Fourth of July. I only wished I could have been going with them. —JKH

The Chief Behind the Guns

If a carrier's principal mission is to launch and recover aircraft, a battleship's is to provide artillery support for sea, land, and amphibious operations. GMCM Charles H. Hill has been a gunner's mate for over 36 years, longer than anyone else in the Navy. His job is to keep Iowa*'s 5-inch and 16-inch guns and the gunner's mates who man them ready for action. The crusty, crew-cutted Texan is plainly thrilled with his assignment, pointing out that having charge of the world's heaviest artillery is a gunner's mate's dream come true. The* U.S. Navy Medicine *Editor recently spoke with GMCM Hill shortly before joining him at his post on* Iowa*'s 0-5 deck for gunnery practice.*

After instructing his men in turret one to load, GMCM Hill awaits the firing of the big guns.

USNM: Have you been a battleship gunner's mate your entire Navy career?
GMCM Hill: No. I've been on minesweepers, destroyers, and carriers. Way back during Korea I served on the heavy cruiser *St. Paul.*

What is so unique about this ship?
We have the only navy in the world with battleships, the only floating platforms with 16-inch guns.

I'm sure you are familiar with the great debate about bringing back ships like this at great expense.
I'm not a politician; I'm a sailor. The way I see it, we need these ships to support the Marines. Before they were recommissioned we didn't have the big guns for shore bombardment. And besides, defensively, this ship can take more punishment than any ship in the world.

Do you mean you can do it better with guns than with missiles?
I think you have a wider range of options with guns than with missiles, at least as far as targets are concerned. Admittedly, guns don't have the range of missiles, but our guns are very accurate and very effective. With what missiles cost, you can't practice with them very often. We can take gunnery practice whenever we think we need it.

Just how effective are these guns in destroying a target?
The 16-inch projectiles weigh 2,700 pounds and each shell takes a charge of 660 pounds of smokeless powder. That's six bags, each weighing 110 pounds. An armor-piercing round will penetrate 30 inches of steel and 30 feet of reinforced concrete. A 1,900-pound high capacity [high explosive] shell will dig a hole 50 feet across and 30 feet deep. One nine-gun salvo landing on a target would obliterate 1 square mile of shoreline.

How fast can a crew load?
A good gun crew that's been together a long time can probably load two rounds a minute. But they have to be well trained and disciplined. There's no room for mistakes. If you make one you won't be around to make another. I was on the *St. Paul* off Korea when a man made a fatal mistake. The resulting explosion killed 30 men.

What happened?
I was standing on the 0-1 level. Turret one was firing to port. I heard two explosions and then smoke began rolling out of the turret. A man had opened the breech on a loaded gun. He was goofing off, not paying attention. When he opened the breech, oxygen hit a slow-burning primer and the powder bag detonated. Most of the casualties in the turret either were burned to death or suffocated.

What is the correct loading and firing procedure?
Everything is done by hand signals. One guy wears headphones so he can hear the turret captain. The turret captain has control of the turret. He's also the safety officer and can stop the firing. He talks to Plot, who sets the computer that provides the target information. We load the guns and Fire Control actually pulls the trigger.

When you fire a broadside, do all guns go off simultaneously?
No. They are fired with a few milliseconds delay in between. It's called a ripple fire. A turret might fire right, center, and left gun in that order.

One would have to admit that we are looking at one of the last battleships. They will never build another one like *Iowa.* How many more years can the Navy expect to get out of a ship like this?
I would say about another 20.

Then you are really a vanishing breed?
I would say that you're probably right. —JKH

The Military Training Network for Resuscitative Medicine

CDR Craig H. Sengbusch, MSC, USN
CAPT Michael L. Cowan, MC, USN
CAPT Donald L. Sturtz, MC, USN
Ann Miller Curiale

The Navy Medical Department has undertaken an ambitious resuscitation training program to enhance the ability of health care providers to act decisively and effectively during life-threatening emergencies. Accidents and heart disease are the major causes of death of active duty personnel. The dangers of combat reinforce the need for military medical department officers highly skilled in life-saving procedures. Severely traumatized patients or the victims of sudden cardiac death both have dramatically increased chances of survival with a Medical Department commitment to training in Basic Life Support (BLS), Advanced Cardiac Life Support (ACLS), and Advanced Trauma Life Support (ATLS).

Although resuscitation training is primarily driven by support of contingency requirements, the need is also acute in the daily operations of medical facilities. Resuscitation training certification has played an increasingly important role in the validation of quality health care. For many of our civilian counterparts, the courses are prerequisites for accreditation. To make training opportunities in resuscitative medicine widely available demonstrates our concern for the highest standards of medical care and quality assurance.

Over the past 10 years there have been remarkable advances in the abilities of clinicians to resuscitate patients in shock from a variety of etiologies. Improved clinical techniques have shown to be so effective that sponsoring authorities developed standardized training modules and aggressively promoted resuscitation training on a nationwide basis. The earliest programs were in BLS, designed for people without medical training. BLS courses are sponsored by the American Red Cross (ARC) and the American Health Association (AHA) which contain very similar performance standards. The success of BLS training led the AHA to develop the now well-known ACLS course for clinicians.

The American College of Surgeons (ACS) developed the ATLS course to teach the management of the multiple-traumatized patient during the initial evaluation and treatment after injury. ATLS stresses principles of basic management and simple life-saving surgical techniques to afford the victim the best chance of surviving to reach definitive surgical care.

Thc outstanding characteristics of all these courses is that they are standardized, compact, straightforward, and relatively easy to learn. They do not attempt to teach all there is to know about the subject but emphasize the most critical aspects. Although they are useful to specialists who apply the techniques frequently, their value is greater for those who resuscitate infrequently. By their nature, resuscitation attempts occur suddenly and unexpectedly, and there is seldom, if ever, adequate time to "review." To be successful, the clinician must have a solid working knowledge based on sound training.

There is probably no medical organization that stands to gain more from resuscitation training than Navy medicine. Our far-flung and sometimes isolated treatment facilities, ashore and afloat, often leave clinicians with few resources other than their own skills in an emergency. The Medical Department must be certain that those clinicians are capable of providing life-saving care.

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Dr. Cowan is on the National Faculty for Cardiac Life Support, Navy Military Training Network.

Dr. Sturtz is chairman, Navy Committee on Trauma, American College of Surgeons.

Ms. Curiale is on the Basic Cardiac Life Support National Faculty, U.S. Military Training Network.

Besides the immediate clinical implications, ACLS and ATLS training have a broader impact on medical and contingency readiness. The immediate value of ATLS is clear—the ability to properly stabilize traumatized patients in the field, the battalion aid station, and in the triage areas of medical facilities can improve battle casualty survival potential. Equally important may be the "processes" taught: both ACLS and ATLS stress the importance of straightforward and linear logic processes under difficult conditions. Experience in field training exercises with simulated patients shows that health care professionals at all levels, who have been exposed to such training, have a better concept of the teamwork, discipline, and identification of priorities which lead to operational effectiveness.

Recognizing the preceding, the Navy Surgeon General, VADM Lewis H. Seaton, MC, directed that all physicians and dental officers reporting to ships or Marine Corps units would be trained in ACLS and ATLS. The major difficulty in meeting that commitment is that the organizations of the authorizing agencies are not well suited to the geographic dispersion and mobility of the Navy. The requirement to provide training at remote or overseas duty stations and to provide universally recognized certification of instructors was apparent, and a search for viable solutions undertaken. A Military Training Network (MTN) was formed when it was determined that the most effective answer would be an independent and fully authorized military organization.

The Military Training Network for Resuscitative Medicine is a Tri-Service organization headquartered at the Uniformed Services University of the Health Sciences (USUHS). Its mission is to facilitate resuscitation training in BLS, ACLS, and ATLS for military personnel. Within the network, each individual service is responsible for its own training programs. This paper reports on the current status and future plans for resuscitation training in the Navy Medical Department.

ACLS

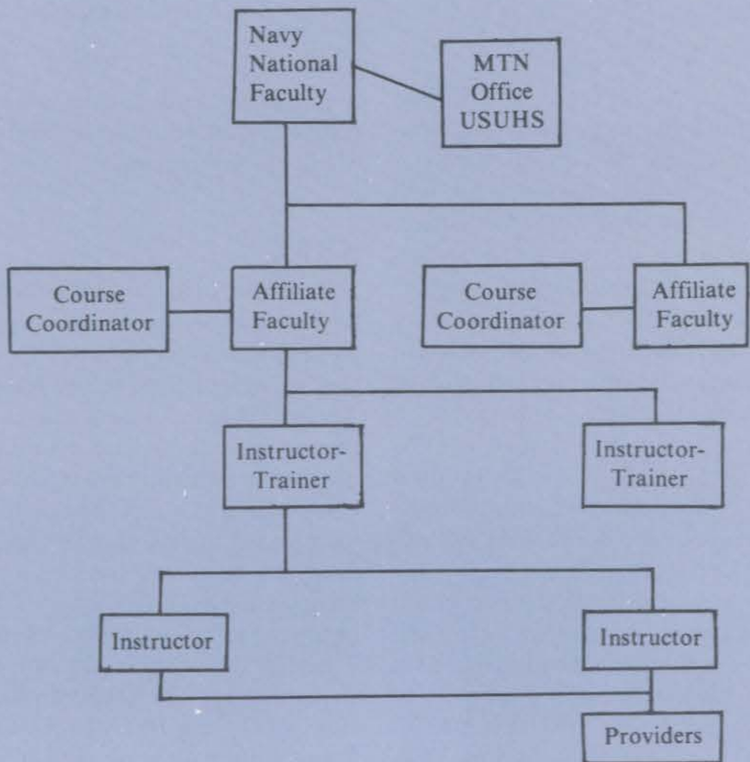
Based on an agreement between the Department of Defense Health Council and the Subcommittee on Emergency Cardiac Care of the AHA, the Armed Forces can now officially authorize BLS and ACLS courses without geographical constraints. The Commander of the Naval Medical Command provided personnel and financial resources for the development of a BLS/ACLS task force to implement training programs in 1984. Through the cooperation of USUHS President Jay P. Sanford, M.D., a functional Navy BLS and ACLS program with a central certifying and recordkeeping authority was achieved.

Prior to the formation of this system, ACLS training at naval medical facilities had often been a personal function of motivated individuals who

TABLE 1
Self-Sufficient ACLS Programs Within Navy MTN

Affiliate Location	Faculty	Administrator/ Coordinators	Number of Courses Since 1982
National Capital	Dr. Edward Lynch	S. Hancock	18
Southwest	Dr. Coleman Mosley	Janet Miller	9
Northwest	Dr. Kristine Batten	Craig Carr	12
Northeast	Dr. Daniel Schneider	Charles Mount	19
Mid-Atlantic	Dr. Rodney Savage	J. Lucas	40
Southeast	Dr. Frank Kuczler		3
European	Dr. M. Mittleman		5
Pacific	Dr. John Miller	Martha Mangan	6

TABLE 2
BLS/ACLS Chain of Command—MTN



- Executes COMNAVMEDCOM policy re: BLS & ACLS
- Authorizes courses
- Liaison to ECCC of AHA

- Executes command policy for ACLS training
- Trains and certifies instructor-trainers and instructors

- Train instructors under direction of AFFAC

- Train providers under direction of AFFAC

sponsored courses and coordinated efforts with local AHA affiliates. Without an institutionalized administrative structure with high command priority, these programs have had poor track records of survival. They would often fail whenever the program director or instructors were routinely transferred, or the local civilian affiliate was unable to support their needs. The task force concentrated its initial efforts on institutionalizing ACLS training within command educational offices to avoid program failures.

Working through the Geographic Commands, clinics and hospitals have created administrative structures and a cadre of instructors, instructor-trainers, and affiliate faculty (AFFAC) capable of operating independently. With the assistance of the task group, functioning as a unit of four individuals, the training centers and their reporting network have been organized rapidly and effectively.

CAPT Michael L. Cowan, MC, Navy National Faculty for BLS and ACLS, provides guidance and policies for conducting ACLS courses and programs within the Navy. The administrator of the MTN has been CDR Craig H. Sengbusch, MSC, who gave direction in establishing regional and local ACLS programs, and served as the educator for instructor courses. An additional dimension is added to the task force by Ms. Ann Miller Curiale, who brings her experience as an emergency medical technician to the task force as Navy Affiliate Faculty for BLS and ACLS and the MTN BLS coordinator. The Hospital Corps is represented by HM3 Claire Hamm, who serves as the resource coordinator for both the task force and the MTN. She works closely with command course coordinators in scheduling, course material, and equipment.

The MTN has initiated training centers in Navy medical treatment facilities in both CONUS and overseas commands (Table 1). In addition to Navy commands, the task force has been called upon to conduct ACLS courses for other military services and government agencies including the White House medical staff and the Central Intelligence Agency. Most recently, the Navy's experience was utilized in establishing a similar BLS and ACLS program at the U.S. Army's Gorgas Community Hospital in Panama.

The hierarchy for BLS/ACLS training is illustrated in Table 2. The National Faculty (NATFAC), nominated by the Surgeon General and appointed by the AHA, acts as liai-

son to the AHA, and provides professional oversight and guidance to training in the Navy. The MTN Office is responsible for logistic and professional support to start and maintain programs.

AFFAC are nominated by Navy medical treatment facility commanders and appointed by NATFAC. They are responsible to implement command policy in BLS and/or ACLS training, and to report NATFAC for course authorization and certification. All training in the assigned area is the responsibility of the AFFAC who is authorized to train and certify instructors, instructor-trainers, and providers, and to schedule courses as required by his or her command. Most AFFAC have designated course coordinators located in command education offices who assume much of the burden of the logistics and administration of training.

The newly created network centers are self-sufficient and maintain themselves by training and certifying instructor-trainers and instructors as required. USUHS provides coordination of the three services and performs liaison for cooperative courses and the exchange of instructors.

The concept of self-sufficient yet interdependent local training networks within the Navy Medical Department has been highly successful. By January 1985 less than 1 year after its formation, the Navy had created or certified programs in more than half the Navy's medical treatment facilities. The Navy experience validates the concept of the MTN as a mechanism to implement resuscitation training within the uniformed services, particularly at remote or overseas duty stations. It has also demonstrated that quality ACLS training need not be dependent upon the geographical constraints of State boundaries. Working within established military command structures, self-sufficient training networks can be established and coordinated to make the best use of federal funding and Department of Defense instructors.

The use of a small task force dedicated to initiating these programs has avoided a potentially ponderous bureaucracy which could hamper the development of self-sufficient training structures for Navy medical commands. A small group has been able to create the administrative mechanism necessary to institutionalize ACLS training quickly, without redundant paperwork or additional bureaucratic burden to the participating facilities. Consolidation of ACLS programs in geographic regions has allowed limited resources of funds, equipment, and instructors to be highly effective at reduced cost. Command education offices, staffed with administrative and instructional personnel, determine training requirements and gather the required equipment and instructors to provide the courses.

Local programs have several options to provide training and may find it most efficient and cost-effective to utilize Navy resources, other military organizations in their area, or local affiliates of the AHA. The best way to provide quality training at minimum cost varies from program to program, so flexibility and innovation are encouraged. Alternative solutions to problems can often be found by commands utilizing the expertise of the task group.

Using the variables in Table 3, command education officers can quickly estimate the cost-effectiveness of establishing an in-house program. The point at which training needs are sufficient to consider a self-sufficient program usually falls between 90-120 providers/year (which corresponds to three to four courses/year). This level of training activity is also adequate to maintain the strength of a program and the skills of the instructors. When fewer than three courses/year are given, program failure rates rise dramatically.

In areas where alternate sources of training are not readily available, this cost analysis is less applicable; some commands may have little choice but to provide in-house training. It is often possible, especially for small or isolated commands with limited training needs, to save money through hybrid programs. Agreements with local programs to share resources, equipment, and instructors can be very productive. Support may also be obtained from military programs in other services, either locally, or through the MTN at USUHS.

The bottom line for whatever program is selected is the acquisition of high-quality training. Cheap courses are no bargain if the training is poor.

TABLE 3
Comparisons of Typical Training Costs

	Civilian Sources	MTN
Equipment	$ 0	$5,000*
Equipment Maintenance	$ 0	$ 500/Year*
Provider	$200	$ 25
Instructor	$300	$ 25
Instructor-Trainer	$300	$ 25
Travel	Variable	Variable
Instructor time	0-Minimal	Variable

*Except for equipment and equipment maintenance, costs indicated are approximations for the training of one individual.

The standards of the MTN are strict, matching, and often exceeding those of local civilian chapters. Involvement with the MTN requires a proportionate commitment.

ATLS

Since 1980 the ACS has authorized ATLS training under the supervision of the Navy chairman and military members of the ACS Committee on Trauma. Such training has been accomplished and continues periodically at Naval Hospitals in San Diego, Oakland, Portsmouth, Rota, Subic Bay, Okinawa, and Yokosuka, Japan. Approximately 600 Medical Department officers have successfully completed these courses. At present, 500 active duty Medical Department officers take the C4 course each year, the majority of whom successfully complete the ATLS portion. However, all these courses do not completely meet our needs. The requirement for recertification every 4 years, as well as the training needs of those who do not attend C4, make additional training opportunities necessary.

Other Medical Department personnel have attended USUHS-sponsored courses in Bethesda, and the MTN, with the support of the Navy Health Sciences Education and Training Command (HSETC), has provided courses in the Far East, Mexico, and Egypt utilizing a mobile training team. The success of the mobile ATLS team has demonstrated that courses can be provided in isolated duty stations despite the difficult logistics of ATLS requirements.

In order to meet future needs, efforts have been initiated to strengthen existing courses and to develop training programs at other sites under the MTN.

BLS

Since BLS training is a fundamental skill required by a wide range of medical and nonmedical personnel, it would seem appropriate for the new MTN to have approached this issue first. However, it was decided to begin with the ACLS and ATLS portions of the network based on two observations. ACLS/ATLS programs have historically been more difficult for local medical facilities to maintain than BLS. Throughout the Navy, both in medical and line communities, BLS programs were found to be operating in conjunction with local AHA or ARC affiliates with usually good results, and MTN assistance was deemed to be less critical than for ACLS/ATLS programs. The resources of the newly formed MTN were severely limited, and it was feared that the numbers of people in need of BLS training could overtax its capabilities.

At present, the greater part of the ACLS/ATLS formation process has been accomplished, and the organization for course maintenance and quality assurance established. The MTN began to turn its attention to BLS beginning with the line community in January 1986, when a pilot MTN BLS program was initiated at the Engineering Services School of the Naval Training Center (NTC), Great Lakes. That program is scheduled to grow in measured degrees to encompass all of NTC within the next fiscal year. In addition, instructors and instructor-trainers who rotate from NTC to fleet assignments will serve as foci for initiation of satellite MTN programs wherever needed throughout the Navy. Local programs throughout the Navy that wish to join the MTN will be provided assistance upon request.

MTN programs for BLS will provide services wherever needs cannot be fully met by local AHA and ARC resources. To date, the NTC program has been highly successful and has shown a Medical Department commitment to support of line operational needs. Controlled growth of the training centers will allow quality assurance and maintain a program of high value.

Summary

The MTN has demonstrated that the Medical Department can successfully promote resuscitation training systems throughout the world. The capability to train and retrain as necessary to prevent degradation of skills is now widely available and will soon be fully functional, making resuscitation training available to all who require it. A new Naval Medical Command instruction is under consideration, and the Navy Officer Occupational Classification System has been modified to allow incorporation of ACLS and ATLS training completion or certification into an officer's data card. The sailors and marines we support can be assured that the Navy Medical Department is providing training of the highest standards equal to the requirements of both operational support and our peacetime mission of high quality medical care to all our beneficiaries. □

Jeannette Update

ICEBOUND: The Jeannette Expedition's Quest for the North Pole. By Leonard F. Guttridge. 357 pages. Naval Institute Press. $23.95.

Rarely will you find a book review in *U.S. Navy Medicine.* But now there is good reason for an exception. The recent publication of *Icebound* is not only an exciting addition to the literature of polar exploration but timely for those armchair explorers eager to follow the *Jeannette* saga (see *U.S. Navy Medicine,* March-April 1984).

In 1879, at the instigation of *New York Herald* owner, James Gordon Bennett, the U.S. Navy became a reluctant partner in a unique and hazardous enterprise, a voyage to seek the North Pole. The story of the *Jeannette* is one of the most fascinating yet tragic chapters in 19th century maritime history. Bennett supplied the ship and funds, Congress the enabling legislation, and the Navy the vessel's officers and men. The mission was to reach the North Pole from a novel direction, through the Bering Strait rather than via the Northwest Passage route from the Atlantic. This strategy was based on a then fashionable theory that a warm Pacific current existed that flowed ice-free all the way to the Pole.

If the goal itself seemed noble and daring, it was really the fate of the brave men and their heroic captain, LT George De Long, that captured the public's imagination. Just a few weeks out of San Francisco, the ship became hopelessly trapped in the polar ice, remaining imprisoned there to drift aimlessly for almost 2 years. Eventually, the floes crushed the steamer and her crew was forced to embark on an epic journey to reach safety. Some eventually were rescued; the remainder perished in the Siberian wilderness.

While imprisoned in the pack, the explorers endured the capricious wrath of nature. The author describes the demonic onslaught of ice and we feel the terror of frail men with no place to run. "It approached at the slow-torture speed of a man's walk. Sometimes ceasing to advance, the floes tossed in ferment as though they had paused only to fight among themselves. One such halt lasted long enough for De Long to think that the cruel game was in abeyance, that the diabolical intelligence controlling the ice had enjoyed its caprice for the day. But, in fact, lulls in the frozen bedlam were murder on already frayed nerves, and it was an almost merciful relief when the ice again ran riot. Gathering bulk as the floes telescoped and mashed against each other, an enormous wall dully gleaming white rolled head-on for the *Jeannette.*"

One by one misconceptions upon which the voyage was based are flung aside. The northward moving, warm Pacific current guaranteeing a ice-free passage to the Pole proves nonexistent. Wrangel Land, believed to be an extension of Greenland, is really an island; there will be neither a safe harbor nor free sledding north. The notion that arctic ice yielded unlimited quantities of potable water bodes ill for the crew, forced to consume precious coal to operate a fresh water still.

And then there is the cast of characters. Some pale with human frailty, others shine with resourcefulness and the stuff of gothic heroism. The resentful and insubordinate Jerome Collins, James Gordon Bennett's handpicked meteorologist, weighs heavily on skipper De Long's mind as does the plight of his navigator, John Danenhower. The latter's history of mental illness is further complicated by a mysterious eye infection, and he must suffer repeated and excruciating operations to relieve the condition under the most primitive of surgical circumstances. The operator, Surgeon James Ambler, fits the heroic mold, sworn to care for his men and choosing to share their fate when life runs out.

Many books have covered this ill-fated enterprise. Even before the last of the explorers' remains were returned, the *Jeannette's* naturalist, Raymond Newcomb, offered a tribute to his fellow comrades in *Our Lost Explorers.* On the heels of that work, George De Long's ambitious and adoring widow "sanitized" and rushed her husband's *Ship and Ice Journals* into print. George Melville, the steamer's gifted and resourceful engineer, told his version 2 years later in 1885. One book published in 1938 related the story through Melville's fictionalized reminiscences.

But whether novelized fact or innocent or self-serving memoir, none ever told the whole story. It would take a good historian and the patience of a detective to search beyond De Long's *Ship and Ice Journals.* The author would spend years sifting through primary sources—family correspondence, newspapers, naval records, journals, and the proceedings of a congressional inquiry. The skeletons and other unmentionables, some offensive to Victorian sensibilities, would then be pried from the closet and put in perspective. And the mysteries would be resolved. As the *Jeannette* tragedy unfolds in *Icebound,* we must remind ourselves that this is first rate human drama and not fiction. It has indeed been told many times before but never like this. Mr. Guttridge has had the last say and has done so in magnificent fashion. —JKH

Evaluation of the Systolic Murmur

LCDR Robert A. Blacky, MC, USN
LCDR Rodney W. Savage, MC, USN

Bedside auscultation of the heart remains a fruitful part of the physical examination. Discovery of a systolic murmur compels the examiner to determine if the murmur is due to cardiovascular pathology or normal cardiovascular functioning. Fortunately, the etiology of most systolic murmurs can be identified through the combination of the auscultatory characteristics of the murmur, a careful cardiovascular history, a chest X-ray, and an electrocardiogram.

Etiology and Classification of Murmurs

Murmurs occur when the bloodflow through the heart becomes turbulent. This turbulence may be produced by a stenotic or incompetent valve, dilation or constriction of a great vessel, a defect in the cardiac septum, or high rates of blood flow through the cardiovascular system.

Murmurs may be classified as innocent, functional, or organic. A murmur is termed *innocent* if the cardiovascular system is normal in all respects and the patient is free of diseases which might alter cardiac function. A *functional* murmur implies a normal cardiovascular system with altered cardiac function due to a superimposed condition affecting the body. An *organic* murmur is produced by an abnormality of the cardiovascular system, usually a defect in a valve, the cardiac septum, or a great vessel.

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Characteristics of Systolic Murmurs

Innocent Murmur. This is the most common systolic murmur heard in most patients at one time or another. In general, these murmurs are short in duration and occupy early or midsystole. They are faint in intensity (usually grade 1 to grade 3), low or mid frequency in pitch, and crescendo-decrescendo or decrescendo in form. They are not associated with an ejection sound or "click" and the first and second heart sounds (S1 and S2) are normal. Usually these murmurs are best heard along the mid or lower left sternal border but may be heard in several locations on the chest wall.

In general, the intensity of these murmurs varies markedly with the performance of the various bedside maneuvers. These murmurs characteristically decrease with valsalva and standing and may decrease with inspiration. Typically, the patient is asymptomatic, the EKG is normal, and the chest X-ray reveals no abnormalities. Patients with innocent murmurs need no further cardiac evaluation, are able to live a vigorous, active life, and do not warrant bacterial endocarditis prophylaxis with antibiotics.

Six different types of innocent murmurs have been described.(*1*) ***Aortic outflow murmur*** is produced by turbulence in the aorta. It is the most common innocent murmur and is best heard in the right second intercostal space near the sternum or along the left sternal border.(*2*) ***Pulmonic outflow murmur*** results from turbulence due to vibrations in the pulmonary trunk or pulmonary leaflets. It is best heard near the sternum in the left second intercostal space and must be differentiated from pulmonic stenosis or an atrial septal defect (see below). (*3*) ***Still's murmur*** is an early or midsystolic murmur best heard in young patients along the left sternal border with the patient in the recumbent position. Typically, it has a groaning, croaking, vibratory, or slightly musical quality. The etiology of Still's murmur is unclear.(*4*) ***Supraclavicular bruit*** is a midsystolic murmur that originates at the origins of the brachiocephalic arteries and is best heard in the supraclavicular fossae just above the medial aspect of the clavicle. It is usually louder on the right side of the neck and is more intense above (rather

than below) the clavicles on the chest wall. It is crescendo-decrescendo in shape and should occupy no more than one-third of systole. If the duration of the murmur is longer, carotid or subclavian arterial occlusive disease must be ruled out. Hyperextension of the patient's shoulders will characteristically decrease or extinguish this murmur.(*5*) ***Mammary souffle*** is heard in late pregnancy or in the early postpartum period and is created by turbulence due to the increased blood flow in the vessels of the breasts. It is systolic or continuous (extends through systole into diastole) and is usually best heard in the right or left second and third intercostal spaces. It is crescendo-decrescendo in shape and relatively high-pitched. Digital pressure or compression with the bell of the stethoscope over the area of the breast where the murmur is loudest will diminish or obliterate the murmur.(*6*) ***Venous hum*** is a rough, noisy, occasionally high-pitched continuous murmur heard in the medial supraclavicular fossae, especially on the right. The intensity of the murmur may be increased by deep inspiration, by sitting upright, or by turning the patient's head away from the side of the neck being examined. The murmur typically is louder in diastole and can be abolished by digital compression of the jugular vein on the side being examined.

Functional Murmur. This systolic murmur is commonly heard when the body hemodynamics are affected by some condition extrinsic to the cardiac system. Disease states which may alter the cardiac hemodynamics include such diverse entities as anemia, thyrotoxicosis, beriberi, widespread Paget's disease of the bone, or fever (from any source). Other, more physiologic conditions which may produce functional murmurs include pregnancy and bradycardia. The functional systolic murmur produced by the various conditions listed above usually results from turbulence of bloodflow through the major vessels (especially at the branch points of the vessels) or through normal valvular structures in the heart. The history and physical examination usually alert the examiner to the systemic nature of the conditions producing functional murmurs.

Organic Murmur. This is the most important type of systolic murmur to detect and correctly identify. An organic murmur is due to a defect in the cardiovascular system and often requires further diagnostic testing and/or therapy. Correct identification of an organic murmur may help prevent untoward complications for the patient and may improve his/her long-term prognosis.

Aortic stenosis is an aortic outflow obstructive disease which is due to congenital valvular defects, degenerative valvular disease with fibrosis or calcification, or rheumatic involvement. Most patients with aortic stenosis are asymptomatic but symptoms of fatigue, angina, dyspnea, or syncope may be noted. The early diagnosis of aortic stenosis is vital since death occurs within approximately 2 years in patients with aortic stenosis and heart failure, 3 years with coexistent syncope, and 5 years with coexistent angina. In addition, there is approximately a 3 percent incidence of sudden death in patients with tight aortic stenosis.

Aortic stenosis is characterized by a systolic crescendo-decrescendo murmur best heard in the second intercostal space on the right of the sternum. The murmur commonly radiates to the carotid arteries or to the apex. It is a harsh, rasping murmur of variable intensity and pitch. As the severity of aortic stenosis increases, the murmur typically becomes longer, peaks later in systole, becomes more intense (grade 3 or greater), and may have an associated thrill. With severe aortic stenosis and left ventricular failure, the murmur may become softer or inaudible. A sustained apical lift may be palpable. The murmur usually becomes louder with squatting, or after a premature ventricular contraction. The murmur diminishes with standing. With valsalva, the murmur is decreased in intensity but becomes louder several cardiac cycles (usually 5-10) after relaxation of valsalva. Evaluation of the heard sounds and carotid pulses are often very helpful in diagnosing aortic stenosis. S1 is usually soft and, in milder degrees of stenosis, may be followed by an ejection click before the onset of the murmur. S2 may be single or paradoxically split (an audible split occurs in expiration, not in inspiration). A fourth heart sound (S4) may be prominent. The carotid pulse has a small, sustained, delayed upstroke and a palpable shudder may be noted.

A chest radiograph is usually normal early in the course of the disease. As the disease progresses, however, calcification of the aortic valve, post-stenotic dilation of the ascending aorta, left ventricular enlargement, or congestive heart failure may become evident. The electrocardiogram may be normal or may reveal left ventricular hypertrophy and left atrial enlargement.

All patients who have aortic stenosis on clinical examination warrant cardiology referral for further workup, especially if they are symptomatic. Bacterial endocarditis antibiotic prophylaxis should be given prior to all dental or surgical procedures.

Mitral regurgitation is a complex disorder which may be due to many

causes including rheumatic valvular disease, endocarditis, disruption of the papillary muscles or chordae attached to the valve, or distortion of the annulus surrounding the valve. The regurgitant murmur depends upon the etiology of the disease. Typically, the murmur is apical, holosystolic, and blowing. It usually radiates to the axilla or posteriorly to the back. Occasionally, the murmur is best heard along the left sternal border and may radiate into the carotid arteries. The intensity of the murmur does not correlate with the severity of the disease. The first heart sound (S1) may be soft and a prominent S3 or S4 may be present. As left ventricular enlargement occurs, the point of maximum impulse (PMI) becomes displaced and enlarged. Unlike the murmurs of aortic stenosis or IHSS (see below), the murmur of mitral regurgitation will intensify with sustained handgrip. In contrast to aortic stenosis, the murmur's intensity shows little change after a premature contraction. It may become louder with sudden squatting or with expiration, and may soften with sudden standing or with valsalva (the murmur then intensifies 5-10 cycles after release of valsalva).

Left ventricular and left atrial enlargement are seen radiographically. If the patient is symptomatic, pulmonary congestion is common. The patient's EKG usually reveals left axis deviation, left ventricular hypertrophy, and left atrial enlargement. Atrial fibrillation is a common rhythm disturbance.

Patients with chronic mitral regurgitation may remain asymptomatic for many years. Eventually, however, symptoms of fatigue, dyspnea, and exercise intolerance develop. Orthopnea and paroxysmal nocturnal dyspnea follow. Patients with acute mitral regurgitation or symptomatic chronic mitral regurgitation should be referred to a cardiologist for evaluation for surgery or pharmacological therapy. Patients with asymptomatic mitral regurgitation should be followed with serial examinations and should be referred to a cardiologist should symptoms develop or signs of cardiac enlargement occur. Endocarditis prophylaxis is indicated.

Mitral valve prolapse is a condition which exists in 5-10 percent of the general population and is due to billowing of the mitral valve into the left atrium during systole causing a variable amount of mitral regurgitation. The murmur of prolapse is audible after a systolic click (which may be single, multiple, or, at times, absent), and is usually crescendo to A2 (aortic second heart sound). The murmur is high-pitched and a distinctive whoop or honk may be intermittently heard. Often the honk can be best heard with the patient leaning forward in a sitting or standing position. The murmur is usually maximal along the lower left sternal border.

The prolapse murmur responds dramatically to the various bedside maneuvers, changing not only in intensity but also in duration; the position of the systolic click also changes. Importantly, the murmur becomes longer and louder with the valsalva maneuver or with standing. In addition, the systolic click moves toward S1 with these maneuvers. With maximal sustained handgrip the click and onset of the murmur occur later in systole but may become more intense. With squatting and following a premature contraction, the maneuver may become softer and the systolic click and murmur will be delayed. The timing of the onset of the systolic click and the duration of the murmur are more characteristic than the changes in murmur intensity when performing these maneuvers.

The chest radiograph and electrocardiogram are usually normal in prolapse. Most patients are asymptomatic but palpitations or noncardiac chest pain may occur.

The disposition of the patient depends upon the clinical situation. Since a small, but significant, proportion of patients with prolapse may develop progressive mitral regurgitation over a 10- to 15-year period, all patients warrant careful attention to their cardiac examination during subsequent routine physical evaluations. Asymptomatic patients with a late systolic click and murmur, a normal chest X-ray, and a normal EKG, should have followup examinations every 1-3 years and should be reassured about their favorable prognosis. Endocarditis prophylaxis for mitral valve prolapse remains controversial, but is generally recommended when a murmur consistent with mitral regurgitation is heard. Conservative authorities would recommend endocarditis prophylaxis for all patients with a click and/or murmur which is consistent with prolapse. Cardiology evaluation is selectively helpful in those patients with atypical findings, evidence of significant mitral regurgitation, or symptoms.

Atrial septal defect (ASD) is a patency in the intra-atrial septum which may be subtle. Patients with an ASD may be asymptomatic until the third or fourth decade. However, progressive symptoms of dyspnea, fatigue, or palpitations occur in almost all patients by the fourth decade. The murmur heard in association with an ASD is a midsystolic, crescendo-decrescendo, grade 1 to 3 murmur best heard along the left sternal border at the second or third intercostal space secondary to turbulent bloodflow through the pulmonic valve. Notably, S2 is widely split and does not vary with respiration. In addition, S1 may be split. In patients with pulmonary hypertension, a right-sided S4 may be heard. A prominent right ventricular cardiac impulse may be palpated. Bedside maneuvers are of little help in diagnosing an atrial septal defect. During valsalva, the fixed split of S2 persists.

Electrocardiographic and radiographic findings are usually helpful. The EKG often reveals atrial arrhythmias (especially atrial fibrillation), a prolonged P-R interval, a RSR complex in the right precordial leads, and occasional right ventricular hypertrophy. The chest X-ray shows an enlarged pulmonary trunk and central pulmonary arteries, right ventricular enlargement, and, in the absence of pulmonary hypertension, increased

pulmonary vasculature. Patients with suspected atrial septal defects should be referred to cardiology for further evaluation and possible surgery. Endocarditis prophylaxis may be recommended in selected cases.

Ventricular septal defect (VSD) is less common in the adult population than an ASD. Patients with a VSD usually have a history of a murmur since childhood, frequent respiratory infections, or a recent myocardial infarction.

The VSD murmur is typically a rough, high frequency, holosystolic murmur best heard along the left sternal border in the third and fourth interspaces. It radiates poorly to the apex but may be transmitted to the right precordium or the axilla. Often a thrill is palpable along the mid-left sternal border. The second heart sound is usually normal but may have an exaggerated splitting with inspiration. A third heart sound (S3) is present at times. In patients with associated pulmonary hypertension, the murmur may be a midsystolic crescendo-decrescendo murmur best heard at the left second intercostal space. Without pulmonary hypertension the murmur increases in intensity with sustained handgrip or squatting but decreases with inspiration and valsalva (the murmur increases in intensity several cardiac cycles after relaxation of valsalva).

Electrocardiographic evidence of a VSD includes right ventricular hypertrophy and/or left ventricular hypertrophy. Radiographically, an enlarged pulmonary trunk with biventricular enlargement may be seen. In the absence of marked pulmonary hypertension, increased pulmonary vascular markings may be noted.

Patients with hemodynamically significant VSD's note dyspnea on exertion and easy fatigability. If the lesion is congenital, the patient may have signs of reduced growth. All patients with a ventricular septal defect should be referred to a cardiologist for evaluation. Bacterial endocarditis prophylaxis is strongly advised.

Idiopathic hypertrophic subaortic stenosis (IHSS) is a dynamic outflow obstruction which is due to the apposition of a thickened interventricular septum and an abnormally moving mitral valve leaflet. Reduced left ventricular volume exacerbates the obstruction. The murmur is crescendo-decrescendo, best heard along the lower left sternal border radiating to the apex but not well transmitted to the carotids. S4 is prominent and an S3 may be present. Unlike aortic stenosis, an ejection click is not heard with IHSS. S1 and S2 are normal. Characteristically, the carotid artery upstroke is brisk with a double systolic impulse (biferiens quality). IHSS has a unique response to bedside maneuvers. The murmur distinctively intensifies when standing or performing the valsalva maneuver. It also becomes louder after a premature contraction. It becomes softer with squatting or maximal sustained handgrip.

Radiographic findings in patients with IHSS may include left ventricular enlargement or left atrial enlargement. Late in the course of the disease, signs of pulmonary congestion may occur. The patient's EKG might reveal left ventricular hypertrophy, left atrial enlargement, and Q waves or Q-S patterns in the inferior and precordial leads. Arrhythmias or conduction disorders are common.

Many patients with IHSS are asymptomatic. Some patients note angina, dyspnea, palpitations, or syncope. These patients have an increased risk of sudden death due to malignant arrhythmias. Patients with suspected IHSS should be referred for echocardiographic confirmation of the disorder and further evaluation. Antibiotic prophylaxis should be administered to combat the increased risk of bacterial endocarditis.

Pulmonic stenosis is due to a congenital valvular abnormality in the vast majority of adults with this lesion. Typically, the murmur is crescendo-decrescendo, best ausculated in the left second or third intercostal space at the sternal border. The murmur radiates upward to the suprasternal notch and the base of the left neck. An ejection click is usually heard and S2 may be widely split on inspiration. As the severity of the stenosis increases, the murmur becomes more prolonged and peaks later in systole. With severe stenosis, a right-sided S4 may be heard and a left sternal thrill may be felt. In patients with significant pulmonic stenosis, the "atrial" wave of the jugular venous pulse is increased while the carotid artery pulse is normal or slightly reduced. Bedside diagnostic maneuvers are of minimal help. Most characteristic of pulmonic stenosis is a slight decrease in murmur intensity with maximal sustained handgrip. Also notable is the immediate return of murmur intensity after release of valsalva (which causes the murmur to become softer).

Mild pulmonic stenosis usually results in no electrocardiographic abnormalities. More severe stenosis produces right ventricular hypertrophy and right atrial enlargement. Chest radiography may show right ventricular enlargement, poststenotic dilatation of the pulmonary arteries, and normal peripheral pulmonary vasculature. Patients with mild, moderate, or even severe stenosis may be asymptomatic. Symptomatic patients usually note fatigue and dyspnea on exertion; occasionally, chest pain or syncope is reported. Patients with mild or moderate pulmonary stenosis are managed medically. Cardiology referral should be obtained for confirmation of the diagnosis and assessment of severity. Symptomatic patients and/or those with severe stenosis are often treated with valvotomy. Endocarditis prophylaxis should be given although the incidence of endocarditis is low in patients who are not drug addicts.

Less Common Organic Murmurs. ***Tricuspid regurgitation*** is a holosystolic murmur best heard at the left lower sternal border that may radiate laterally. It is accompanied by marked jugular venous distension with a prominent "ventricular" wave, hepatomegaly which may be pulsatile, and peripheral edema. A left parasternal lift may be felt and a right-sided S3 is often heard. The EKG usually reveals

right atrial enlargement and right ventricular hypertrophy. Atrial fibrillation is common. Right atrial or ventricular enlargement is often seen on chest X-ray.

Coarctation of the aorta produces a crescendo-decrescendo systolic or continuous (loudest in systole) murmur best heard over the back, especially between the scapulae. The carotid artery pulses are bounding whereas the femoral artery pulses are weak and delayed. The systolic blood pressure taken in the arms is greater than that of the legs. The chest X-ray may show notched ribs due to dilated intercostal vessels.

Peripheral pulmonary artery stenosis produces a systolic crescendo-decrescendo or continuous murmur loudest over the back or at the axilla. The radiographic findings of coarctation of the aorta are absent, the femoral artery pulses are normal, and the blood pressure in the legs is similar to that in the arms (within 10-20 mmHg). Right ventricular hypertrophy may be present on EKG. A ***pulmonary arteriovenous fistula*** produces a long systolic or continuous murmur best heard over the portion of the chest wall closest to the site of the fistula. The murmur's intensity and duration increase with inspiration. Again, no radiographic evidence of aortic coarctation is present and the lower extremity arterial pulses and blood pressure are normal. ***Patent ductus arteriosus*** typically produces a continuous murmur peaking around S2 that is most prominent at the left sternal border in the first or second intercostal space. S2 may be paradoxically split, the carotid arterial pulse is brisk or bounding, and a wide pulse pressure is present. Finally, a ***pericardial friction rub*** may be mistaken for a murmur. It has a superficial, scratchy, scraping quality and may be heard in midsystole, middiastole, and late diastole (any or all components may be present). It is usually loudest at the left lower sternal border and may be augmented by pressure on the chest wall with the bell of a stethoscope during auscultation. The EKG may reveal diffuse elevation of the S-T segments, widespread T-wave changes, and P-R segment depression. Chest radiographs may show cardiomegaly, occasionally with a "water-bottle" configuration.

Summary

In conclusion, the correct diagnosis of the etiology of a systolic murmur depends upon a careful history, a detailed assessment of the murmur's characteristics and responses to various physiological maneuvers, and associated radiographic and electrocardiographic findings. With this relatively simple evaluation, the vast majority of systolic murmurs can be etiologically defined, appropriate treatment instituted, and timely, appropriate referral initiated.

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The Navy Environmental Health Center will sponsor the 29th Naval Occupational Health and Preventive Medicine Workshop 27 February—5 March 1987 at the Holiday Inn, Waterside Area, Norfolk, VA.

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Logo Winner Announced

The September-October 1985 *U.S. Navy Medicine* announced a Navy Medical Department-wide contest selecting logos for the two new hospital ships, *Mercy* and *Comfort.* After over 150 submissions and judging by a design committee and the Surgeon General, the two winning logos were recently announced. Both designs are the handiwork of CWO4 Robert G. Stevenson of Naval Medical Clinic, San Diego. CWO4 Stevenson will be an honored guest at the official naming ceremony for USNS *Mercy* in San Diego on 8 Nov 1986.

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